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Sustainable economic–environmental planning in Southeast Europe – beyond-GDP and climate change emphases

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ABSTRACT
This study's objectives are (1) application of a quantitatively sound approach to the evaluation of economic and environmental sustainability for 10 Southeast Europe (SEE) countries, including comparison with the developed countries of Germany, France and the Russian Federation, and (2) evaluation of the effects of chosen sustainability indicator weights, especially of the GDP-PPP, climate change and the income equality Gini index, as sustainability parameters. One applied scenario is with the level of sustainable economic development assessed by a traditional approach, based on high weight of GDP-PPP, and another assigns lesser weight to the GDP-PPP and higher weight to natural wealth and income equality, i.e. a 'beyond-GDP' goal. The sustainability of environmental development was determined by a common approach based on high importance of climate change indicators and an approach, perhaps more suitable for developing countries of SEE, that gives higher weight to their agriculture, forestation and energy usage. Assigning higher weights to natural wealth and social equality encouragingly demonstrated that this results in the same or higher sustainability rankings for the SEE countries, and for some even higher than those of the developed countries. Developing countries that have relatively low GHG emissions and energy use, and GDP well above the poverty level, should consider basing their sustainable development on raising the relative weights for natural wealth and income equality, and lowering it for the GDP. Methodology recommendations are offered to sustainable development planners and policy-makers. Uniformity and scientific consensus-based standardization of sustainability analysis methodology are critically needed. Copyright © 2017 John Wiley & Sons, Ltd and ERP Environment

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Introduction

THE PRINCIPLE OF SUSTAINABILITY IS REFLECTED MOST IN THE NEED TO RESPECT THE BASIC POSTULATES OF SUSTAINABLE development, that is, first, the concept of intergenerational justice (Parris and Kates, 2013). The development must be designed and implemented so that the next generations have sufficient resources available to meet their needs. Any country trying to implement sustainable development would thus encounter many challenges (Hopwood *et al.*, 2005). A problem is that, so far, neither the scientific community nor practice have clearly defined or accepted a way to measure and express sustainability (Deaton, 2010; Krank *et al.*, 2013). Probably the only agreed fact is that rapid economic growth often has a negative impact on the quality of the environment, while often not fully acknowledging that social wellbeing of the citizens depends both on economic progress and on adequate care of the environment – two otherwise conflicting entities (Carwed-Reid *et al.*, 2013).

Already from the very beginning of the planning and analysis, the mere description of economic development, and especially of measurement indicators, creates problems, mainly related to the extensive use of GDP (gross domestic product) (Bass and Dalal-Clayton, 2012; Radovanovic *et al.*, 2013). An initial technical problem in a typical process of strategic governance of conducting such a sustainability plan and analysis is a weak data and methodology infrastructure (Dalal-Clayton & Bass, 2009). This is especially common in countries that have an underdeveloped system of data collection, those that have large areas and those that do not yet have adequate ways to comprehend, evaluate and inventory existing resources (Schoenaker *et al.*, 2015, Mukhjerjee and Chakraborty, 2013).

Experience shows that the countries of Southeast Europe (SEE), and developing countries in general, usually opt in the initial phase for rapid economic development, regardless of the environmental damage that it may incur (Steurer and Hametner, 2013). This trend is observed in the new member states of the European Union (Estonia, Lithuania, Czech Republic, Poland, Bulgaria and Romania), achieving strong economic momentum in the first years after joining the EU, accompanied by an associated intense deterioration of environmental quality (Pickard, 2008). After a few years, their economic growth has slowed down, but concern about the environment has still not been addressed (Golušin and Munitlak- Ivanović, 2009).

Research Methodology

Monitoring of the state of sustainable development indicators covered 10 SEE countries, as well as two developed European union countries and the Russian Federation for comparison.

- Countries of SEE:
  - those that are not EU members – Albania (AL), Serbia (SRB), Bosnia and Herzegovina (BiH) and Former Yugoslav Republic of Macedonia (M)
  - those that are EU members – Bulgaria (BG), Greece (GR), Hungary (H), Slovenia (SL), Croatia (CR) and Romania (RO).
- Developed EU countries for comparison: France (FR) and Germany (G).
- Developed non-EU country for comparison: Russian Federation (RF).

The data analysis was performed using the method of composite indicators, which employs weight coefficients for each indicator (OECD and JRC, 2008; Lior, 2015). The method allows subjective accounting of the importance of an indicator for a given time and country (Blanc *et al.*, 2008), and is applicable to data that may be expressed in different units of measurement (as in this and similar cases). The method has three stages (OECD and JRC, 2008):

1. *Scaling*. Scaling techniques aim at transforming (normalizing) variables to make them comparable based on a common unit.

In this study the normalization is for each indicator type j (e.g. GDP-PPP, energy consumption, CO_2 emissions and such), and is relative to all the countries in the chosen set of N countries $i = 1$ to N, with the normalized

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indicators $z_{i,j}$ (indexed by country i and indicator type j) calculated by the *min–max method* from the values of the 'raw' (pre-normalized) indicators $x_{i,j}$ for country i and indicator type j, which are found in appropriate databases,

$$z_{i,j} = \frac{x_{i,j} - x_{\min,j}}{x_{\max,j} - x_{\min,j}} \tag{1}$$

where for country i and indicator type j, $z_{i,j}$ is the value of the normalized indicator (dimensionless and positive by definition), $x_{i,j}$ is the value of the pre-normalized indicator, $x_{\max,j}$ is the highest value of the pre-normalized indicator among the set of N considered countries and $x_{\min,j}$ is the minimal value of the pre-normalized indicator among the set of N considered countries, with all x values having the dimensions by which these 'raw' indicators are measured (e.g. $, tons, % etc.), and can be positive or negative.

It is important to note that this method as applied here ranks the countries according to the relative magnitude of their 'raw' indicators $x_{i,j}$, with $z_{i,j}$ scaled from 0 to 1, where $z_{i,j} = 0$ for the countries that have the very lowest value of the 'raw' indicator, $x_{min,j}$, and $z_{i,j} = 1$ for the countries that have the very highest value of the 'raw' indicator, $x_{max,j}$.

2. *Weighting*. There are several ways to weight indicators, such as equal weighting, weighting based on statistical methods and weighting based on expert/public opinion polls. Weighting may also not always measure the importance of each individual indicator, but sometimes rather the urgency and importance of change.

   For a number J of weights for each country i, in this study we chose to assign values $w_{i,j}$ to each weight so that

$$\sum_{j=1}^{J} w_{i,j} = 100 \tag{2}$$

   where $j = 1, 2, ..., J$ is the weights' type index. All weights are assumed to be positive.

3. *Aggregation*. This is the final step in the process of constructing a composite index. According to determined values and weight coefficients, the value of a *composite sustainability index* (*CSI*) is calculated here by using a technique shown by

$$\mathrm{CSI}_i^t = \sum_{j=1}^{J} w_{i,j}^t \cdot z_{i,j}^t \tag{3}$$

assuming (as usual) that the number of indicators is equal to the number of corresponding weights J, indexed as $j = 1, 2, ..., J$, where CSI_i^t is the composite sustainability index of country i at time t, $z_{i,j}^t$ is the value of the normalized indicator z indexed by weight type j, for country i at time t, J is the number of indicator types, equal to the number of corresponding weights, used, and $w_{i,j}^t$ is the weight associated with individual indicator$z_{i,j}^t$ at time t (%).

Based on the indicators and weights chosen for evaluating the sustainability of a country and using the above-described method, the composite sustainability indicator (CSI) values are calculated separately for economic sustainability (composite *economic* sustainability indicators, CEcSI) and for environmental sustainability (composite *environmental* sustainability indicators, CEnSI), and finally for a combined composite *economic–environmental sustainability index* defined here as CEESI = (CEcSI + CEnSI)/2, all for several weighting scenarios defined later.

Indicators and Results

The Economic Indicators of Sustainable Development

While past comprehensive sustainability analyses used a large number of indicators, usually around 100 or more, the analysis in this paper is focused on issues pertinent to SEE; it serves in part to demonstrate the methodology and uses 10 such economic and 10 environmental indicators, described in Table 1.

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Economic indicators (source: www.cia.gov)		Environmental indicators (source: DESTATIS – Statistisches Bundesamt, Germany-2014.)	
Indicator (*x*)	Measure (units)	Indicator (*x*)	Measure (units)
GDP-PPP	US$/person	Agricultural land	% of nation's land area
Public debt	%; the fraction of public spending that is financed by borrowing instead of taxation	Arable land and permanent crops	% of nation's land area
Unemployment rate	% of working population	Forest area	% of nation's land area
Inflation	% changes in the consumer price index (CPI)	Organic agriculture area	% of nation's land area
Gini[a]	numbers 0 to 100	Primary energy use	kg oil-equivalent/person
Investments share in GDP	%; gross capital formation as percentage of the GDP.	Carbon emission	metric tons/person
GDP real growth rate	%; annual rate of change	Water dependence[b]	%
External debt	$ per capita	Methane emissions[c]	metric tons of CO_2-equivalent/person
Industrial growth	%; annual % increase in industrial production (incl. Manufacturing, mining and construction)	Nitrous oxide emissions[d]	metric tons of CO_2-equivalent/person
Export	$/person	Fertilizer consumption[e]	kg/(hectare arable land)

Table 1. The sustainable development indicators (*x*) used in this study: definitions and units (2014)
[a]The Gini index measures the degree of inequality in the distribution of family income in a country, 0 is for complete equality and 100 for complete inequality (i.e., one person has all the national income). For example, CIA (2015) shows that the world's countries had Gini coefficients between 23.0 (Sweden) and 63.2 (Lesotho).
[b]Indicator expressing the percent of total renewable water resources originating outside the country. This indicator may theoretically vary between 0% and 100%. A country with a dependence ratio equal to 0% does not receive any water from neighboring countries. A country with a dependence ratio equal to 100% receives all its renewable water from upstream countries, without producing any of its own. This indicator does not consider the possible allocation of water to downstream countries (FAO, 2013).
[c]World Bank, 2013a.
[d]World Bank, 2013b.
[e]World Bank, 2012.

Table 2 presents the list of basic economic indicators of development used in this study.

There is an increasing international concern that the GDP is significantly overvalued in comparison with indicators that represent social quality. We have therefore examined two economic scenarios with indicator weights that differ in this way: one, Scenario A (Table 3), that we call 'GDP over social economic preference', which prioritizes the GDP-related goals (actually the GDP-PPP related ones), and one, Scenario B (Table 4), that we call 'social over GDP economic preference'.

The results for Scenario A after the normalization of the chosen indicators' values are presented in Table 3.

After normalization of the input values, the results under Scenario A show that the country with the highest value of the composite economic sustainability indicators (CEcSI) is Germany (78.40). The second highest values are for Hungary (68.30) and Slovenia (67.85), mainly because of low levels of public debt and high levels of industrial and GDP growth. The value for France is 58.70, which puts France in the fifth rank position, mainly because of low values of GDP growth and industrial growth, accompanied by high external debt. Countries with similar values (between 49 and 54) are Albania, Russia, Macedonia and Bulgaria, as countries with high level of unemployment, inflation, investment in GDP and GDP growth. Bosnia & Herzegovina and Greece are lowest. The worst ranking in the group is for Serbia (27.80), because of low economic indicators.

The results of the analysis for Scenario B ('social over GDP economic preference') are presented in Table 4.

The values of SEcSI under Scenario B show significant differences from those under Scenario A, as also depicted in Figure 1.

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Indicator		GDP-PPP	Public debt	Unem-ployment	Inflation	Gini index	Invest-ments in GDP	Growth of GDP	External debt	Industrial growth	Export
					x values						
Albania	AL	11 000	71.4	13.3	1.7	34.5	23.7	2.1	882	3.7	387
BiH	BiH	9 800	45.5	44.3	−0.8	36.2	17.7	1.0	2 052	1.2	691
Bulgaria	BG	17 100	22.9	11.0	−0.6	45.3	21.2	1.4	6 261	3.5	2 960
Greece	GR	25 800	174.5	26.8	−0.9	34.4	12.9	0.6	47 636	0.0	2 425
Hungary	H	24 300	78.2	7.10	0.0	24.7	22.0	2.8	14 821	3.1	10 700
Macedonia	M	13 200	34.0	28.0	−0.2	39.2	22.6	3.4	2 668	3.1	2 150
Croatia	CR	20 400	70.3	21.0	−0.2	32.0	18.2	−0.8	13 519	0.4	2 800
Serbia	SRB	12 500	65.0	26.1	2.3	38.0	20.2	−0.5	4 178	−3.0	1 650
Romania	RU	19 400	39.4	7.0	1.2	27.4	22.1	2.4	5 082	3.0	2 800
Slovenia	SI	29 400	59.8	13.6	0.5	23.7	18.1	1.4	25 555	2.8	16 640
France	FR	40 400	95.5	9.7	0.7	30.9	21.6	0.4	86 317	−2.0	8 989
Germany	D	44 700	74.7	5.0	0.9	27.0	20.2	1.4	68 720	1.3	18 865
Russia	RF	24 800	13.4	4.9	9.1	42.0	19.6	0.5	3 634	0.6	3 639

Table 2. The basic economic indicators (x_i, the units are given in Table 1) of sustainable development

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w, %	GDP-PPP 30	Public debt 10	Unemployment 5	Inflation 5	Gini index 5	Investments in GDP 10	Growth of GDP 10	External debt 5	Industrial growth 10	Export 10	Scenario A CEcSI
Albania: z	0.03	0.64	0.79	0.74	0.50	1.00	0.69	1.00	1.00	0.00	
wz	0.90	6.40	3.95	3.70	2.50	10.00	6.90	5.00	10.00	0.00	49.35
BiH	0.00	0.80	0.00	0.99	0.42	0.44	0.43	0.99	0.56	0.02	
wz	0.00	8.00	0.00	4.95	2.10	4.40	4.30	4.95	5.60	0.20	34.50
Bulgaria: z	0.21	0.94	0.85	0.97	0.00	0.77	0.52	0.94	0.96	0.14	
wz	6.30	9.40	4.25	4.85	0.00	7.70	5.20	4.70	9.60	1.40	53.40
Greece: z	0.46	0.00	0.44	1.00	0.50	0.00	0.33	0.45	0.35	0.11	
wz	13.8	0.00	2.2	5.00	2.50	0.00	3.30	2.25	3.50	1.10	33.65
Hungary: z	0.42	0.60	0.94	0.91	0.95	0.84	0.86	0.84	0.89	0.56	
wz	12.6	6.00	4.7.0	4.55	4.75	8.40	8.60	4.20	8.90	5.60	68.30
Macedonia: z	0.10	0.87	0.41	0.93	0.28	0.90	1.00	0.98	0.89	0.1	
wz	3.00	8.70	2.05	4.65	1.40	9.00	10.00	4.90	8.90	1	53.60
Croatia: z	0.3	0.65	0.59	0.93	0.62	0.49	0.00	0.85	0.42	0.13	
wz	9.00	6.50	2.95	4.65	3.10	4.90	0.00	4.25	4.20	1.30	40.85
Serbia: z	0.08	0.68	0.46	0.68	0.34	0.68	0.07	0.96	−0.18	0.07	
wz	2.40	6.80	2.30	3.40	1.70	6.80	0.70	4.80	−1.80	0.70	27.80
Romania: z	0.28	0.84	0.95	0.79	0.83	0.85	0.76	0.95	0.88	0.13	
wz	8.40	8.40	4.75	3.95	4.15	8.50	7.60	4.75	8.80	1.30	60.60
Slovenia: z	0.56	0.71	0.78	0.86	1.00	0.48	0.52	0.71	0.84	0.88	
wz	16.8	7.10	3.90	4.30	5.00	4.80	5.20	3.55	8.40	8.80	67.85
France: z	0.88	0.49	0.88	0.84	0.67	0.81	0.29	0.00	0.00	0.47	
wz	26.4	4.90	4.40	4.20	3.35	8.10	2.90	0.00	0.00	4.70	58.95
Germany: z	1.00	0.62	1.00	0.82	0.85	0.68	0.52	0.21	0.58	1.00	
wz	30.00	6.20	5.00	4.10	4.25	6.80	5.20	1.05	5.80	10.00	78.40
Russia: z	0.43	1.00	1.00	0.00	0.15	0.62	0.31	0.97	0.46	0.18	
wz	12.9	10.00	5.00	0.00	0.75	6.20	3.10	4.85	4.60	1.80	49.20

Table 3. Scenario A – 'GDP over social economic preference': normalized basic economic sustainability indicators (z), weights ($w_{i,j}$) and composite economic sustainability indicators (CEcSI)

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w, %	GDP-PPP 15	Public debt 10	Unemployment 10	Inflation 5	Gini index 20	Investments in GDP 5	Growth of GDP 5	External debt 10	Industrial growth 10	Export 10	Scenario B CEcSI
Albania: z	0.03	0.64	0.79	0.74	0.50	1.00	0.69	1.00	1.00	0.00	
wz	0.45	6.40	7.90	3.70	10.00	5.00	3.45	10.00	10.00	0.00	56.90
BiH: z	0.00	0.80	0.00	0.99	0.42	0.44	0.43	0.99	0.56	0.02	
wz	0.00	8.00	0.00	4.95	8.40	2.20	2.15	9.90	5.60	0.20	41.40
Bulgaria: z	0.21	0.94	0.85	0.97	0.00	0.77	0.52	0.94	0.96	0.14	
wz	3.15	9.40	8.50	4.85	0.00	3.85	2.60	9.40	9.60	1.40	52.75
Greece: z	0.46	0.00	0.44	1.00	0.50	0.00	0.33	0.45	0.35	0.11	
wz	6.90	0.00	4.40	5.00	10.00	0.00	1.65	4.50	3.50	1.10	37.05
Hungary: z	0.42	0.60	0.94	0.91	0.95	0.84	0.86	0.84	0.89	0.56	
wz	6.30	6.00	9.40	4.55	19.00	4.20	4.30	8.40	8.90	5.60	76.65
Macedonia: z	0.10	0.87	0.41	0.93	0.28	0.90	1.00	0.98	0.89	0.10	
wz	1.50	8.70	4.10	4.65	5.60	4.50	5.00	9.80	8.90	1.00	53.75
Croatia: z	0.30	0.65	0.59	0.93	0.62	0.49	0.00	0.85	0.42	0.13	
wz	4.50	6.50	5.90	4.65	12.4	2.45	0.00	8.50	4.20	1.30	50.40
Serbia: z	0.08	0.68	0.46	0.68	0.34	0.68	0.07	0.96	−0.18	0.07	
wz	1.20	6.80	4.60	3.40	6.80	3.40	0.35	9.60	−1.80	0.70	35.05
Romania: z	0.28	0.84	0.95	0.79	0.83	0.85	0.76	0.95	0.88	0.13	
wz	4.20	8.40	9.50	3.95	16.6	4.25	3.80	9.50	8.80	1.30	70.30
Slovenia: z	0.56	0.71	0.78	0.86	1.00	0.48	0.52	0.71	0.84	0.88	
wz	8.40	7.10	7.80	4.30	20.00	2.40	2.60	7.10	8.40	8.80	76.90
France: z	0.88	0.49	0.88	0.84	0.67	0.81	0.29	0.00	0.00	0.47	
wz	13.2	4.90	8.80	4.20	13.4	4.05	1.45	0.00	0.00	4.70	54.70
Germany: z	1.00	0.62	1.00	0.82	0.85	0.68	0.52	0.21	0.58	1.00	
wz	15.00	6.20	10.00	4.10	17.00	3.40	2.60	2.10	5.80	10.00	76.20
Russia: z	0.43	1.00	1.00	0.00	0.15	0.62	0.31	0.97	0.46	0.18	
wz	6.45	10.00	10.00	0.00	3.00	3.10	1.55	9.70	4.60	1.80	50.20

Table 4. Scenario B – 'social over GDP economic preference': normalized basic economic sustainability indicators (z), weights ($w_{i,j}$) and composite economic sustainability indicators – CEcSI (the weights $w_{i,j}$ that were changed from Scenario A are in bold font)

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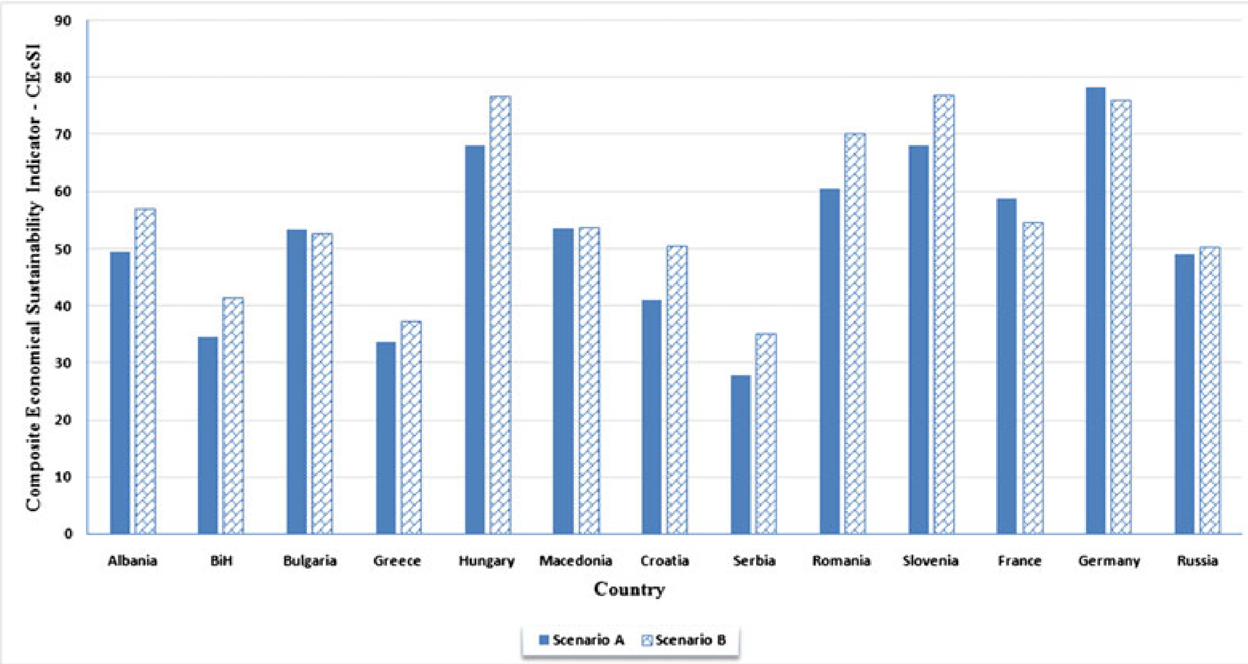

Figure 1. Comparison between the countries' composite *economic* sustainability indicators (CEcSI) under Scenario A 'GDP preference over Gini' and those under Scenario B 'social over GDP economic preference' [Colour figure can be viewed at wileyonlinelibrary.com]

- Under Scenario B, ranking changes by more than one position were found for only three countries, rising for Albania and Slovenia and dropping for Germany.
- Recalling that the normalized indicators $z_{i,j}$ are the same for both scenarios, the chosen weights $w_{i,j}$ generate a larger or smaller value of 2. Examination of the individual $(w_{i,j} \cdot z_{i,j})$ values (in Tables 3 and 4) will show that they become higher for some indicator types j and becomes lower for others. Such detailed examination also allows determination of the relationship between the magnitudes of the ranking value SEcSI as a function of the choice of weights.
- Membership of SEE countries in the EU had little effect on the change of their relative ranking between Scenarios A and B.
- It is noteworthy that under Scenario B Germany dropped in ranking from the first position to the fourth, while Slovenia rose from third to first.
- The lowest ranked country under both scenarios was Serbia.

Comparison of the results obtained by using Scenario A (favoring of GDP) and Scenario B (favoring of social preferences) shows clear differences in both results and ranking. It is noteworthy that even under Scenario A the highest ranked countries in the set are Germany, Hungary and Slovenia.

A very interesting case is that of France and Romania, which are commonly perceived as very differently developed economically. Under Scenario A, France has almost the same ranking of economic sustainability as Romania. France has a higher GDP-PPP, the values of Gini index are the same, but the values of most of its other indicators are lower.

Environmental Indicators of Sustainable Development in Countries of SEE

Table 5 shows the basic (raw) values of the environmental indicators. We again established and used two scenarios. The commonly used Scenario C (Table 6) assigns high priority to abating global climate change (we call it 'GHG reduction over natural wealth preference'). Scenario D, 'natural wealth over GHG reduction preference' (Table 7),

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Indicator		Agricultural land	Arable land	Forest area	Soil under organic	Primary energy use	CO_2 emission	Water dependence	Methane emission	Nitrous oxide emission	Fertilizer consumption
						x values					
Albania	AL	43.8	25.4	28.2	0.5	748	1.2	10.93	0.86	0.37	90.9
BiH	BiH	42.3	21.8	42.8	0.0	1848	6.1	5.33	0.28	0.28	99.3
Bulgaria	BG	47.2	32.0	37.2	0.8	2615	6.6	1.41	1.73	0.65	121.8
Greece	GR	63.3	28.6	30.7	5.7	2343	7.4	15.22	0.78	0.47	100.6
Hungary	H	59.0	50.6	22.6	2.4	2369	4.8	94.23	0.25	0.25	97.1
Macedonia	M	50.2	17.8	39.9	0.4	1484	4.4	50.04	0.65	0.25	57.2
Croatia	CR	23.7	17.6	34.4	2.4	1971	4.3	64.27	1.13	0.66	300.8
Serbia	SRB	57.8	40.9	32.1	0.2	2237	6.9	8.22	0.91	1.03	175.1
Romania	RO	59.7	40.2	28.9	2.1	1778	3.8	8.04	1.20	0.41	49.8
Slovenia	SI	23.8	9.9	62.4	7.3	3472	7.4	41.42	1.46	0.59	265.0
France	FR	52.7	35.2	29.3	3.6	3834	5.0	5.21	1.26	0.58	136.9
Germany	D	47.8	34.5	31.8	6.2	3822	9.1	30.52	0.71	0.52	198.9
Russia	RF	13.1	7.4	49.4	0.1	5113	11.6	4.32	0.01	4.49	15.7

Table 5. The basic environmental indicators (x_i; the units are given in Table 1) of sustainable development

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w, %	Agricultural land 5	Arable land 10	Forest area 5	Soil under organic 5	Primary energy use 5	Carbon emission 25	Water dependence 5	Methane emission 20	Nitrous emission 20	Fertilizer use 10	Scenario C CEnSI
Albania: z	0.61	0.42	0.14	0.07	1.00	1.00	0.90	0.50	0.97	0.74	
wz	3.05	4.20	0.70	0.35	5.00	25.00	4.50	10.00	19.4	7.40	79.60
BiH: z	0.58	0.33	0.51	0.00	0.75	0.53	0.96	0.84	0.99	0.71	
wz	2.90	3.30	2.55	0.00	3.75	13.25	4.80	16.8	19.8	7.10	74.25
Bulgaria: z	0.68	0.57	0.37	0.11	0.57	0.48	1.00	0.00	0.91	0.63	
wz	3.40	5.70	1.85	0.55	2.85	12.00	5.00	0.00	18.20	6.30	55.85
Greece: z	1.00	0.49	0.20	0.78	0.63	0.40	0.85	0.55	0.95	0.70	
wz	5.00	4.90	1.00	3.90	3.15	10.00	4.25	11.00	19.00	7.00	69.20
Hungary: z	0.91	1.00	0.00	0.33	0.63	0.65	0.00	0.86	1.00	0.71	
wz	4.55	10.00	0.00	1.65	3.15	16.25	0.00	17.20	20.00	7.01	79.90
Macedonia: z	0.74	0.24	0.43	0.05	0.83	0.69	0.48	0.63	1	0.85	
wz	3.70	2.4	2.15	0.25	4.15	17.25	2.4	12.6	20	8.5	73.40
Croatia: z	0.21	0.24	0.30	0.33	0.72	0.70	0.32	0.35	0.90	0.00	
wz	1.05	2.40	1.50	1.65	3.60	17.5	1.60	7.00	18.00	0.00	54.30
Serbia: z	0.89	0.78	0.24	0.03	0.66	0.45	0.93	0.48	0.82	0.44	
wz	4.45	7.80	1.20	0.15	3.30	11.25	4.65	9.60	16.4	4.40	63.20
Romania: z	0.93	0.76	0.16	0.29	0.76	0.75	0.93	0.31	0.96	0.88	
wz	4.65	7.60	0.80	1.45	3.80	18.75	4.65	6.20	19.2	8.80	75.90
Slovenia: z	0.21	0.06	1.00	1.00	0.38	0.40	0.57	0.16	0.92	0.13	
wz	1.05	0.60	5.00	5.00	1.90	10.00	2.85	3.20	18.4	1.30	49.30
France: z	0.79	0.64	0.17	0.49	0.29	0.63	0.96	0.27	0.92	0.57	
wz	3.95	6.4	0.85	2.45	1.45	15.75	4.8	5.4	18.4	5.7	65.15
Germany: z	0.69	0.63	0.23	0.85	0.30	0.24	0.69	0.59	0.94	0.36	
wz	3.45	6.3	1.15	4.25	1.50	6.00	3.45	11.8	18.8	3.60	60.30
Russia: z	0.00	0.00	0.67	0.01	0.00	0.00	0.97	1.00	0.00	1.00	
wz	0.00	0.00	3.35	0.05	0.00	0.00	4.85	20.00	0.00	10.00	38.25

Table 6. Scenario C – 'GHG reduction over natural wealth preference': normalized basic environmental sustainability indicators (z), weights ($w_{i,j}$) and composite environmental sustainability indicators (CEnSI)

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W, %	Agricultural land 10	Arable land 15	Forest area 15	Soil under organic 5	Primary energy use 15	Carbon emission 10	Water dependence 10	Methane emission 10	Nitrous emission 5	Fertilizer use 5	Scenario D CEnSI
Albania: z	0.61	0.42	0.14	0.07	1.00	1.00	0.90	0.50	0.97	0.74	
wz	6.10	6.30	2.10	0.35	15.00	10.00	9.00	5.00	4.85	3.70	62.40
BiH: z	0.58	0.33	0.51	0.00	0.75	0.53	0.96	0.84	0.99	0.71	
wz	5.80	4.95	7.65	0.00	11.25	5.30	9.60	8.40	4.95	3.55	61.45
Bulgaria: z	0.68	0.57	0.37	0.11	0.57	0.48	1.00	0.00	0.91	0.63	
wz	6.80	8.55	5.55	0.55	8.55	4.8	10.00	0.00	4.55	3.15	52.50
Greece: z	1.00	0.49	0.20	0.78	0.63	0.40	0.85	0.55	0.95	0.70	
wz	10.00	7.35	3.00	3.90	9.45	4.00	8.50	5.50	4.75	3.50	59.95
Hungary: z	0.91	1.00	0.00	0.33	0.63	0.65	0.00	0.86	1.00	0.71	
wz	9.10	15.00	0.00	1.65	9.45	6.50	0.00	8.60	5.00	3.55	58.85
Macedonia: z	0.74	0.24	0.43	0.05	0.83	0.69	0.48	0.63	1.00	0.85	
wz	7.40	3.60	6.45	0.25	12.45	6.90	4.80	6.30	5.00	4.25	57.40
Croatia: z	0.21	0.24	0.30	0.33	0.72	0.70	0.32	0.35	0.90	0.00	
wz	2.10	3.60	4.50	1.65	10.8	7.00	3.20	3.50	4.50	0.00	40.85
Serbia: z	0.89	0.78	0.24	0.03	0.66	0.45	0.93	0.48	0.82	0.44	
wz	8.90	11.70	3.60	0.15	9.90	4.50	9.30	4.80	4.10	2.20	59.15
Romania: z	0.93	0.76	0.16	0.29	0.76	0.75	0.93	0.31	0.96	0.88	
wz	9.30	11.40	2.40	1.45	11.4	7.50	9.30	3.10	4.80	4.40	65.05
Slovenia: z	0.21	0.06	1.00	1.00	0.38	0.40	0.57	0.16	0.92	0.13	
wz	2.10	0.90	15.00	5.00	5.70	4.00	5.70	1.60	4.60	0.65	45.25
France: z	0.79	0.64	0.17	0.49	0.29	0.63	0.96	0.27	0.92	0.57	
wz	7.90	9.60	2.55	2.45	4.35	6.30	9.60	2.70	4.60	2.85	52.90
Germany: z	0.69	0.63	0.23	0.85	0.3	0.24	0.69	0.59	0.94	0.36	
wz	6.90	9.45	3.45	4.25	4.50	2.40	6.90	5.90	4.70	1.80	50.25
Russia: z	0.00	0.00	0.67	0.01	0.00	0.00	0.97	1.00	0.00	1.00	
wz	0.00	0.00	10.05	0.05	0.00	0.00	9.70	10.00	0.00	5.00	34.80

Table 7. Scenario D – 'natural wealth over GHG reduction preference': normalized basic environmental sustainability indicators (*z*), weights ($w_{i,j}$) and composite environmental sustainability indicators CEnSI (the weights $w_{i,j}$ that were changed from Scenario C are in bold font)

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supports the cogent argument that all of the SEE countries contribute negligibly to global climate change but have important priorities in developing their agriculture and forestation (which in fact also help absorb CO_2), and since they also use only about half or less energy per person relative to developed countries, increased use of energy is important for improving their life quality.

By measuring environmental sustainability (Scenarios C and D), the country rankings are significantly different in comparison with the results obtained by valuation of economic performance (Scenarios A and B). Under Scenario C, the country with the highest level of composite environmental sustainability indicators (CEnSI) is Hungary (79.90). Second in rank is Albania (79.60), as a country with low levels of emissions, fertilizer use and primary energy consumption. Similar reasons for high values can be expressed for Bosnia & Herzegovina, Greece and Macedonia. Poor ranking for Romania and Bulgaria is the result of high emissions of all undesirable gases, accompanied by low forestation. Germany recorded a value of CEnSI of 60.30 and France 65.15, as a result of high water dependence, low level of forestation and intensive use of fertilizers. Russia is the country with the lowest level of CEnSI (38.25), predominantly because of a high level of energy use, high emission of gases and low level of agricultural and arable land.

The resulting values of SEnSI for Scenario D show significant differences from those for Scenario C, as also depicted in Figure 2.

- Under Scenario D, ranking changes by more than one position were found for five countries, rising for Greece, Serbia and Romania, and dropping for Hungary and Macedonia.
- Under Scenario D, the SEE countries except Croatia and Slovenia show higher values of SEnSI, and, including Bulgaria, also higher ranking than the economically most developed countries (in this set) of Germany and France.
- Russia has the lowest value in both scenarios because of its mostly lowest normalized indicators $z_{i,j}$ in this country set.

Under Scenario C, the highest ranked countries are Hungary, Albania and Romania. A most interesting case to comment on is the very similar levels of environmental sustainability for Serbia, France and

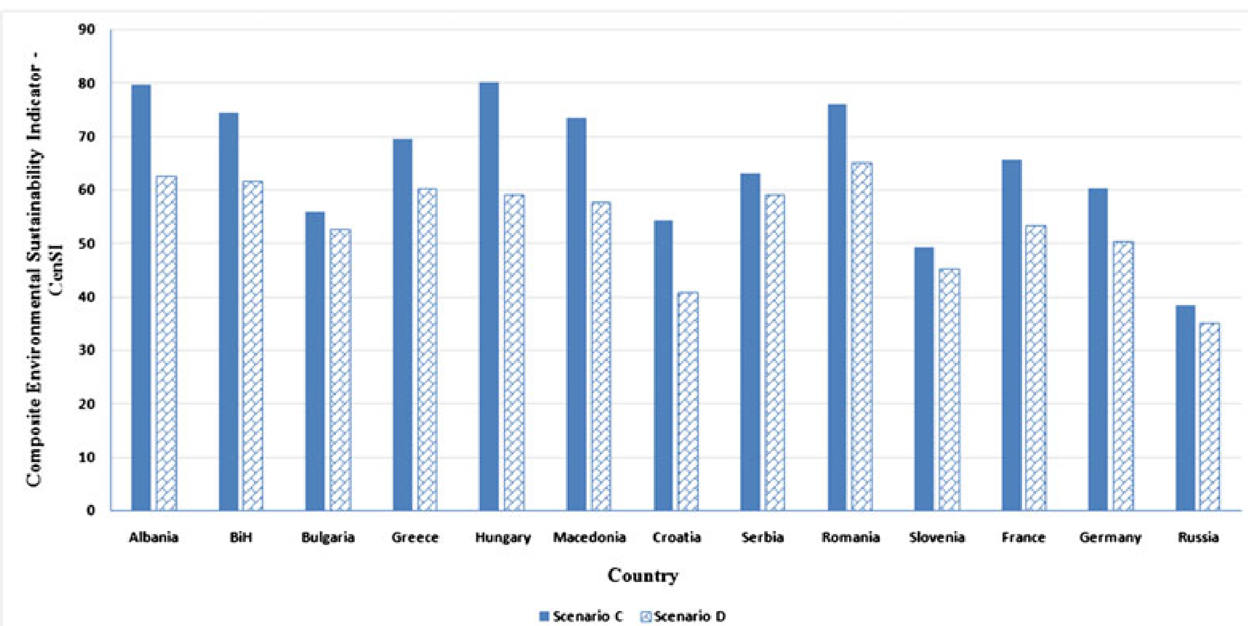

Figure 2. Comparison between the countries' composite *environmental* sustainability indicators (CEnSI) under Scenario C 'GHG reduction over natural wealth preference', and those under Scenario D 'Natural wealth over GHG reduction preference' [Colour figure can be viewed at wileyonlinelibrary.com]

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Country	CEESI for Scenario E – high importance of GDP-PPP and climate change ('the usual econo-environmental')	CEESI for Scenario F – lesser importance of GDP-PPP and climate change ('beyond GDP')
AL (Albania)	64.55	59.65
BiH (Bosnia and Herzegovina)	54.38	51.40
BG (Bulgaria)	54.58	52.58
GR (Greece)	51.53	48.68
H (Hungary)	74.10	67.79
M (Macedonia)	63.48	55.63
CRO (Croatia)	47.64	45.59
SRB (Serbia)	45.36	46.99
RO (Romania)	68.15	67.59
SI (Slovenia)	58.62	61.07
FR (France)	62.08	53.78
G (Germany)	69.25	63.09
RF (Russian Federation)	43.70	42.50

Table 8. Comparative review of the degree of sustainable economic and environmental development (CEESI) by using Scenario E, 'the usual econo-environmental' approach, with the 'beyond GDP' one that may be more suitable for developing countries (Scenario F)

Germany – countries that have very disparate environment-related characteristics. Serbia has higher levels of agricultural land, arable land and forestation in comparison with France. Also, primary energy use in Serbia is significantly lower than in France (2237 kg oil-equivalent/person in comparison with 3834 kg oil-equivalent/person). Methane emission in Serbia is 0.91 tons CO_2-equivalent/person, which is significantly lower than in France (1.26 tons CO_2-equivalent/person).

The Combined Economic–Environmental Level of Sustainable Development

The first aggregation, which we call Scenario E, is the average of the EESI values of Scenarios A and C ('natural wealth over GHG reduction preference'), which therefore be regarded as the more commonly used one in Europe at this time, and which we call 'the usual econo-environmental'. The second aggregation, Scenario F, is the average of the EESI values of Scenarios B and D (named 'beyond GDP'), which can therefore be regarded as more suitable for developing countries. The CEESI values for Scenarios E and F are shown in Table 8 and Figure 3.

- It is most noteworthy that under Scenario F ranking changes by more than one position were found for only one country, raising Slovenia from the seventh place to the fourth, and dropping for Hungary and Macedonia.
- The highest values of CEESI under Scenario F ('beyond GDP', which assigns less importance to the GDP-related indicators and higher importance to natural wealth) are those of Hungary (67.79) and Romania (67.59), followed by Germany (63.09), Slovenia (61.07) and Albania (59.65). $CESSI_F$ of France is similar to those for the countries of SEE. The Russian Federation was found to have the lowest under both scenarios, mostly because of its relatively high pollution indicators.

Suggestions for Strategic Planning of Sustainable Development in Countries of SEE

Strategic conceptualization of the relationship between economic and environmental development is still in an initial phase in countries of SEE and presents the need for a careful examination, by using the accepted theoretical

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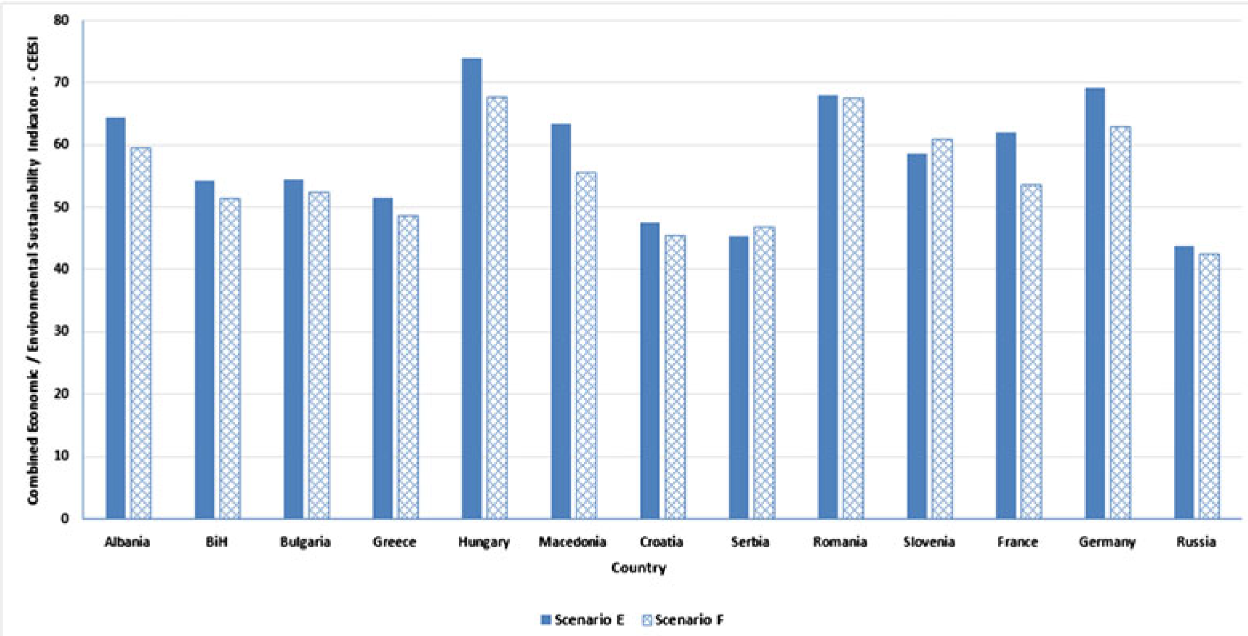

Figure 3. Comparison between the combined composite *economic–environmental* sustainability index (CEESI) that uses 'the usual econo-environmental' Scenario E approach, and the 'beyond GDP' Scenario F [Colour figure can be viewed at wileyonlinelibrary.com]

basis of strategic planning that must be adjusted to requirements of the monitored region and of every country separately. Basically, the process of strategic planning of sustainable development requires surveying in several basic steps:

- understanding of the relationship and causality between economic, environmental and social sustainable development (social was not a focus of this study);
- development and maintenance of acceptably accurate databases, which must be regularly updated;
- understanding of the importance of measurement for establishing sustainable development goals – goals that are real, measurable and achievable;
- understanding of differences that can arise from application of different methods for quantification (assessment), which can lead to wrong planning and unwanted long term consequences;
- clear, adequately comprehensive, transparent, politically independent and objective reporting – for example, lay people are not always able to understand that increase of GDP-PPP can be bad for the environment;
- understanding that countries of SEE have significant natural resources, which represent their assets, currently often neglected in quantification;
- development of control and monitoring measures for implementing the strategy, with appropriate legislation.

Conclusions

In addition to the detailed quantitative results about the relative sustainability of the SEE countries, which are useful by themselves for sustainability assessment and planning, the following general key conclusions were drawn.

- In comparison with the currently usual approach to sustainability that emphasizes GDP and reduction of GHG emissions, assigning higher weights to natural wealth and social equality encouragingly demonstrates that it results in the same or higher sustainability rankings for the SEE countries, and for some even higher than those of the developed countries.

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- It is recommended that developing countries that have globally relatively low GHG emissions and energy use, as well as GDP well above the poverty level, consider basing their sustainable development on raising the relative weights for natural wealth and income equality, and somewhat lower on the relative weight of GDP.
- This also emphasizes the need for proper choice of indicators and of their weights, to enable acceptable country-individualized choices for sustainable development.
- Furthermore, appliers and users of sustainability analysis must have sufficient understanding of the method and of some of its pitfalls, and ability to adapt it to their specific conditions to avoid generation of wrong results.
- It is obviously of critical importance to obtain correct and up-to-date data for the indicators.
- Important concerns about the validity of the analysis outcomes, and its susceptibility to improper manipulation, can and should be lessened by standardization of the measurement and verification of the used data and of the analytical methods, as well as by education of analysts, policy-makers and the public.

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